



# From Virtual Worlds to the Therapist's Office

*Are virtual reality techniques useful in psychotherapy and diagnosis?*

The increasing recognition of the importance of emotional state in both disease and health makes imperative the need for health care providers to evaluate the psychological status of patients. In primary care medical practice, between 30 and 60% of complaints prompting visits to the physician's office have a significant emotional component. In addition, rates of depressive illness are estimated to be as high as 20% in the general population. Prompt recognition of anxiety, depression, personality disorder, and psychosis is important for correct interpretation of historical and physical findings during examination and evaluation of patients. The establishment of a caring and trusting relationship is crucial so that patients can comfortably express concerns, and so that a discussion leading to an agreeable therapeutic plan can be decided upon. This process has traditionally taken place in the one-on-one format between the health care provider and patient. Many physicians and therapists are interested in exploring whether virtual reality can augment the therapeutic process, and thus improve diagnostic capabilities.

## Background

At the present time, immersion of patients into virtual worlds has been used to help overcome several types of fears and phobias. Early investigations involved the use of virtual reality in helping veterans deal with post traumatic stress disorder [1,2].

A recent case report described the successful treatment of an undergraduate student with acrophobia (fear of heights). Using computer-generated virtual reality, a nineteen-year-old undergraduate student was able to successfully overcome his fear of heights in only five sessions. The two most often used behavioral therapies for treating simple phobias to date have been in vivo graded exposure, where

the subject is placed in a real situation and slowly through habituation is taught to overcome the anxiety first provoked by the situation; and systematic desensitization, where the subject is told to "imagine" being in the situation and taught relaxation techniques to slowly reduce anxiety. These techniques have traditionally required many sessions to achieve success. For those therapists who have used systematic desensitization, patients who were not good visualizers have found it hard to "imagine" being in certain scenarios. For those therapists who have used in vivo exposure, the possibility of loss of patient confidentiality has presented a problem. Virtual reality provides a tool that solves both problems [3]. In this age of managed care and rising health care costs, virtual reality is clearly a cost-cutting tool that should be carefully evaluated for implementation in a variety of treatments.

Virtual reality may play a role in reducing test anxiety in college students. Test anxiety, particularly in math and science courses, is a major concern for many college students. Virtual reality devices with electromyography (EMG) attachments have been proposed as a tool for helping students relieve their test anxiety. The EMG electrodes measure muscle tension and can be used to help individuals learn to relax by first recognizing tension. Students could go into the virtual test environment, see the EMG response, and learn to lower their arousal levels. These techniques may be useful in training students to improve performance. [4].

More extensive studies used virtual reality to treat acrophobia (fear of heights) in college students. A controlled study using 17 college students who reported having acrophobia was conducted. A screening questionnaire was given so that only those who fit the criteria for simple phobia, as set forth in the "Diagnostic and

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Statistical Manual of Mental Disorders" (4th Edition), were included in the study. Participants were given a questionnaire assessing attitude toward heights and an acrophobia questionnaire before being selected. Seven sessions were given to the students, during which they were put into three virtual reality situations—a glass elevator, an outdoor balcony, and a bridge. During the sessions, subjects were asked to rate their anxiety level on a scale from 0 to 100, with 0 being no discomfort and 100 being a level of anxiety inducing panic. This was done to insure that their feelings reflected those feelings produced in the actual situation. At pre-test, there were no differences between the control group and treatment group. However, at post-test, the treatment group's level of fear had decreased considerably. The control group's fear had not changed. Some members of the treatment group also voluntarily exposed themselves to actual height situations, although they were not required to do so. This appears to provide evidence for the fact that virtual therapy does carry over to the real world [5,6].

In another study of patients with acrophobia, vital signs including heart rate and blood pressure were measured during therapeutic trials. During the first phase, 88 participants were exposed to virtual reality situations that simulated heights and depths. After one week of exposure, 90% of participants were able to handle exposure to height situations in the real world. At 3 months post-test, 90% were still able to ride in a glass elevator while facing looking out. During the second study, 32 participants were exposed to simulated height and depth environments. Again, 90% were able to face real world height situations [7].

A recent concept paper suggested that virtual reality may be useful during biofeedback therapy. It was suggested in this paper that "alpha EEG signals from the left and right hemispheres could control two separate figures in the virtual world." In addition, the possibility exists that other physiological signals could also be represented in some way in this format [8].

During biofeedback therapy, a person is taught to become aware of his physiological responses—heart rate, skin conductance, blood pressure, and breathing pattern. Immersing the patient in a virtual world while at the same time having him see his own physiological signs, may make him better able to recognize and learn to control his responses to stressors.

Virtual reality may provide a tool for positive reinforcement of behavioral techniques [13].

In a related area, the physiological responses of young adults were monitored during a virtual reality game. The study looked at the responses of those who participated in aggressive virtual reality games and those who only observed. It was found that participants increased physiological arousal, increased heart rate, and increased aggressive thoughts. No such increases were found for observers [9]. More studies of this nature are needed to assess adequately the full effect of video games on participants.

These games may however serve a more constructive purpose and be used to teach conflict management. Design and development of games is underway which can teach seriously emotionally disturbed and learning disabled children conflict management skills. Skills would be practiced in a virtual world and, it is hoped carry over to the real world; allowing these children to function more effectively [10].

Entering a virtual world opens up many other possibilities. We may be able to place individuals in virtual worlds, provide a conflict scenario, and see how they react. Industrial and organizational psychologists could use the tool to help companies in such areas as management training and stress management. Before promotion a management candidate could be placed in different virtual situations and his/her reaction to events recorded. With physiological monitors, one could also tell how the body is truly responding. An employee who is experiencing on-the-job stress could be placed in virtual situations and taught stress management techniques or assertiveness training also.

We may be able to create a virtual world that simulates one's childhood home, or at least a room in that home. By doing so, we may be able to induce a child-like frame of mind again, and help a person relive that terrifying moment when a fear was ingrained. It is conceivable that a therapist could enter the virtual world with the client, thereby making the experience less terrifying. By being able to change the ending to the story this time, a person could change her perception of the event and gain some control over her fear, leading to long-term positive gains [11].

Virtual worlds could also be used in helping individuals learn meditation techniques. By placing a person in a peaceful,

relaxing surrounding; those who cannot quiet their minds on their own might be able to attain some relaxation and transcendence skills [11].

The projected growth of virtual reality as an entertainment, training, and therapeutic tool may have unforeseen risks. A few of the known risks to date are nausea, disorientation, and vertigo which have been reported by pilots who log many simulator hours before being allowed to fly a real plane. Not known is how virtual reality may effect our consciousness and perceptions once we again enter the real world. Also there is the likelihood that some people may not want to leave the virtual world, and may instead wish to stay immersed. Those who have addictive personalities could be at greatest risk, for virtual reality may prove to be but one more drug for them. Since one of the defining characteristics of schizophrenia is a disturbance in perception, one must think of how someone who is mentally fragile might react when placed in a virtual world. The possibilities for alteration of social interactions and human consciousness should be carefully explored and investigated [12].

### **Role of Virtual Reality as a Diagnostic Tool**

The unique relationship humans have with computers might be useful for diagnostic purposes. Many people are more comfortable interacting with or asking personal questions of computers. In San Diego, a telephone bank of pre-recorded health information topics maintained by the San Diego County Medical Society is frequently used by the general population. The most often requested dial-up topic concerns sexually transmitted diseases. The next most common topic is pregnancy. (These data may suggest that health care practitioners could improve their abilities to discuss sensitive topics with patients.) This level of comfort has been used to implement telepsychiatry and other remote or distance technologies, where patients in remote areas do not always have access to physicians.

Another approach under consideration, is to use total immersion in a virtual world as a diagnostic tool. The majority of studies outlined above tend to focus on the virtual situation as a substitute for the real world, and utilize gradual accommodation to the stress-causing environment. An alternative scheme would be to use the virtual environment in a way that selec-

tively presents subject matter or images to the patient, under controlled conditions. Patient responses could be used to gauge reaction to the subject material. This technique could be useful in a variety of situations. If, for example, an eye tracking device was introduced into the VR goggles, then the position and reaction of the eye to controlled images could be studied. This approach has several advantages. First, the image being presented can be controlled and standardized. Second, the response can be quantitated, and finally, subjective feelings of patients can be compared to actual quantitative data.

Related approaches have been used by NASA, and in military simulation exercises. Investigators at Kaiser Permanente are measuring vital signs of patients during "VR therapy" for acrophobia [7]. This ability to control simultaneously the content of information presented to the patient, while monitoring physiological responses, will open up entirely new areas of investigation. Complex psycho-social issues can be presented to patients in a clinically useful and therapeutic manner.

Investigation of the role stress might play in such disorders as hypertension and heart disease may prove very beneficial in lowering their incidence, while at the same time reducing health care costs. Currently, about 20% of individuals in the United States suffer from hypertension. A subset of these individuals seem to benefit from behavior therapy, with biofeedback in conjunction with pharmacological means being the preferred treatment thus far. By placing these patients in virtual environments and teaching them procedures to lower stress levels, their disorder may be alleviated or improved.

Virtual reality also holds promise to enable those who are injured to undergo accelerated rehabilitation. In a virtual world, they may practice skills which they were once capable of and may integrate back into the real world once again by using those skills. For someone who has sustained a serious injury, the virtual

world may be a much safer starting point for beginning therapy [14].

## Conclusion

The use of virtual reality as a diagnostic and therapeutic tool in medical and mental health fields has great potential. Many interesting studies and investigations are ongoing at the present time. Initial published reports show encouraging results in the use of virtual reality for the successful treatment of simple phobias. The use of this technique in more complex psycho-social situations requires further evaluation and study. Using virtual reality to augment the diagnostic capabilities of clinicians and therapists should be explored. The potential benefits of virtual reality add an additional capability to the clinical evaluation and treatment of health and disease.

## References

1. **Henderson J:** *Cyberspace Representation of Vietnam war trauma*. In: Benedikt M (Ed): *Cyberspace*. MIT Press, Cambridge MA, 1990.
2. **Henderson JV:** "Virtual realities" as instructional technology. *Journal of Interactive Instruction Development*. 24-30, Summer 1991.
3. **Rothbaum BO, Hodges LF, Kooper R, Opdyke D, Williford JS, North M:** Virtual reality graded exposure in the treatment of acrophobia: a case report. *Behavior Therapy* 26:547-554, 1995.
4. **Knox D, Schacht C, Turner J:** Virtual reality: a proposal for treating test anxiety in college students. *College Student Journal* 27(3): 294-296, 1993.
5. **Hodges LF, Kooper R, Rothbaum BO, Opdyke D, de Graaff JJ, Williford JS, North MM:** Virtual environments for treating the fear of heights. *Computer Innovative Technology for Computer Professionals*. 28(7): 27-34, 1995.
6. **Rothbaum BO, Hodges LF, Kooper R, Opdyke D, Williford JS, North M:** Effectiveness of computer-generated (virtual reality) graded exposure in the treatment of acrophobia. *American Journal of Psychiatry* 152: 626-628, 1995.
7. **Berg TD:** Virtually unafraid. *Virtual Reality Special Report*. p. 56, May/June 1995.
8. **Budzynski TH:** Virtual reality biofeedback: a brief concept paper. *Biofeedback*. 23(3): 12-13, 1995.
9. **Calvert SL, Tan SL:** Impact of virtual reality on young adults' physiological arousal and aggressive thoughts: interaction versus observation. *Journal of Applied Developmental Psychology*. 15(1): 125-139, 1994.
10. **Rothman P, Oliver D:** Virtual reality games for teaching conflict management with seriously emotionally disturbed (SED) and learning disabled (LD) children. *Virtual Reality and Persons with Disabilities* (Meeting Abstract), June 17-18, 1993, San Francisco. Conference Chairperson: Walter Greenleaf, Greenleaf Medical Systems.
11. **Bard SR:** Virtual reality: An extension of perception.: an interview with Charles Tart. *Noetic Sciences Review*. pp. 7-16, Autumn 1991.
12. **Cartwright GF:** Virtual or real? The mind in cyberspace. *The Futurist*. pp. 22-26, Mar-Apr 1994.
13. **Larijani LC:** *The Virtual Reality Primer*. McGraw-Hill, Inc., New York NY, 1993.
14. **Whalley LJ:** Ethical issues in the application of virtual reality to the treatment of mental disorders. In: Earnshaw RA, Gigante MA, Jones H (Eds): *Virtual Reality Systems*. Academic Press, New York NY, pp 273-287, 1993.



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